

SECTION 16465 ELECTRICAL BUSWAY SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

- A. This Section includes bus assemblies and fittings.
- B. Related Sections: The following sections contain requirements:
 - 1. Section 16120, Building Wire and Cable 600V and Below.
 - 2. Section 16196, Electrical Identification.
 - 3. Section 16450, Grounding.

1.3 REFERENCES

- A. InterNational Electrical Testing Association (NETA)
 - 1. NETA ATS-1995: Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems
- B. National Electrical Manufacturers Association (NEMA)
 - 1. NEMA AB 1-93: Molded Case Circuit-Breakers
 - 2. NEMA BU 1-94: Busways
 - 3. NEMA BU 1.1-91: General Instructions for Handling, Installation, Operation and Maintenance of Busway Rated 600 Volts or Less
 - 4. NEMA ICS 2-93: Industrial Control Devices, Controllers and Assemblies
 - 5. NEMA KS 1-90: Enclosed and Miscellaneous Distribution Equipment Switches
- C. National Fire Protection Association (NFPA)
 - 1. NFPA 70-1999: National Electrical Code (NEC)
- D. Underwriters Laboratories Inc. (UL)
 - 1. UL 486A-91 (Rev. 95): wire Connectors and Soldering Lugs for Use with Copper Conductors
- E. Institute of Electrical and Electronics Engineers (IEEE)
 - 1. IEEE C2-1993, National Electrical Safety Code

1.4 SUBMITTALS

- A. Product Data: Include electrical ratings, dimensions, mounting position, mounting method, vertical supports, materials, firestops, and weatherstops for each component.
- B. Shop Drawings: Detail fabrication and installation of enclosed bus assemblies including plans, elevations, sections, component details, and attachments to other construction elements. Detail Detail supports and connections to building.
- C. Coordination Drawings: Include floor plans and sections to show enclosed bus-assembly layouts and relationships between components and adjacent structural and mechanical

elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.

- D. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- E. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.5 QUALITY ASSURANCE

- A. Listing and Labeling: Provide transformers specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.
- B. Comply with IEEE C2.
- C. Source Limitations: Obtain enclosed bus-assembly components through one source from a single manufacturer.
- D. Enclosed Bus Assemblies, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- E. Comply with NFPA 70 for components and installation.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle bus assemblies according to NEMA BU 1.1.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify existing dimensions by field measurements. Verify clearances and locate obstructions within manufacturing and installation tolerances of enclosed bus assemblies.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Plug-in Units: 10 percent of installed units.
 - 2. Hookstick operator for plug-in units.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - BUSWAY AND PLUG-IN UNITS

- A. General Electric.
- B. Square D.
- C. Cutler Hammer/Westinghouse.
- D. Siemens.

2.2 INDOOR BUSWAY

- A. Plug-In Busway: NEMA BU 1; three phase, four wire low impedance plug-in busway rated 277/480 V, 60 Hz. Provide nonventilated housing with plug-in openings on 24-in. centers each side, with hinged doors to protect opening where plug-in unit is not installed. Ampere ratings as shown on the drawings.
- B. Feeder Busway: NEMA BU 1; three phase, four wire low impedance busway rated 277/480 V and 5 KV, 60 Hz. Provide ventilated housing. Ampere ratings as shown on the drawings.
- C. Conductors: Copper bars, fully insulated except at joints and at plug-in outlets. Provide full neutral on 480 volt system. Provide (insulated) ground bus.
- D. Joints: Provide single-bolt type, with silver-plated contact surface for bus and splice plate.
- E. Bus Bar Supports: Make insulators and supports of glazed porcelain or molded phenolic composition arranged to provide the enclosed assembly with a short circuit to withstand minimum rating of 65,000-rms, symmetrical amperes.
- F. Provide fittings in accordance with manufacturer's instructions.
- G. Supply all bus sections, elbows, tees, end closures, feed boxes, plug-in devices, and associated mounting fixtures from the same manufacturer and design to be used together.
- H. Finish: Baked gray enamel.

2.3 PLUG-IN UNITS

- A. Units
 - 1. Compatible with busway; enclosure with hinged door and operating handle for stick operation. Provide the enclosure with knockouts and the necessary clamps for quick attachment of the plug to the busway.
 - 2. Provide polarized pressure stabs for engaging the bus bar conductors. An insulated ground stab on the plug shall make contact with the ground bar before the plug's phase stabs contact the busway's conductors. Provide a grounding terminal within the plug housing to facilitate the routing of a ground conductor with the load circuit conductors.
 - 3. Design the bus plugs so they can be inserted or removed only when the switch is in the "Off" position.
 - 4. Bus plug fusible-disconnect switch (complete assembly) or circuit breaker minimum interrupting rating: 65,000 A, symmetrical.
- B. Molded Case Thermal-Magnetic Circuit Breakers: NEMA AB 1, circuit breakers with integral thermal and instantaneous magnetic trip in each pole.

2.4 SOURCE QUALITY CONTROL

- A. Perform an insulation-resistance test on each 10-ft section of busway prior to shipment. Minimum leakage resistance (per 10-ft section): 300 megohms.
- B. Perform insulation test with 1,000-V insulation tester (Simpson Model 405 or approved equal). Conduct tests for 1 min or until reading reaches a constant value for 15 s.
- C. Apply tests from each phase bus bar conductor to ground with other phase bus bar conductors grounded.

- D. Record and document test results. Include three copies of test results and three copies of installation instructions with shipment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine rough-in and room dimensions to verify busway layout in the rooms according to the layouts. Verify supports are correctly located and sized according to the system requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install bus assemblies level and plumb and according to manufacturer's written instructions, Shop Drawings, and referenced standards.
- B. Support bus assemblies independent of supports for other elements such as equipment enclosure at connections to panelboards and switchboards, pipe, conduit, ceilings, and ducts.
 - 1. Design each fastener and support to carry 200 lb (90 kg) or four times the supported weight of bus assembly, whichever is greater.
 - 2. Support bus assembly to prevent twisting from eccentric loading.
 - 3. Support bus assembly with not less than 3/8-inch (10-mm) steel rods. Install side bracing to prevent swaying or movement of bus assembly. Modify supports after completion to eliminate strains and stresses on bus bars and housings.
 - 4. Fasten supports securely to building structure according to Division 16 Section "Basic Electrical Materials and Methods."
- C. Install expansion fittings at locations where bus assembly crosses building expansion joints. Install at other locations so distance between expansion fittings does not exceed 90 percent of manufacturer's recommended distance between fittings.
- D. Install firestop fittings where bus assemblies penetrate fire-rated elements such as walls, floors, and ceilings. Seal around penetration according to Division 7 Section "Firestopping" as directed by authorities having jurisdiction.
- E. Install appropriate weatherseal fittings and flanges where bus assemblies penetrate exterior elements such as wall or roof. Seal around openings to make weathertight.
- F. Install a concrete curb at least 3 inches (75 mm) high around bus-assembly floor penetrations.
- G. Coordinate bus-assembly terminations to equipment enclosures to ensure proper phasing, connection, and closure.
- H. Tighten bus-assembly joints with torque wrench or similar tool recommended by bus assembly manufacturer. Tighten joints again after bus assemblies have been energized for 30 days.
- I. Install bus-assembly plug-in units. Support connecting conduit independent of plug-in unit.
- J. Connect bus assemblies and components to wiring system and to ground as indicated and instructed by manufacturer.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

3.3 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing:
 1. After installing enclosed bus assemblies and after electrical circuitry has been energized, test for compliance with requirements.
 2. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.4. Investigate any insulation-resistance reading less than **100 megohms divided by bus-assembly length in feet** (**30 megohms divided by bus-assembly length in meters**). Certify compliance with test parameters.
- B. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

3.4 ADJUSTING

- A. Set field-adjustable overload trips to match motor loads.
- B. Align bus-assembly runs vertically and horizontally to eliminate sags and twists. Provide additional stiffeners if required to restrict excessive movement.

3.5 CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris. Repair damaged finish to match original finish.

3.6 PROTECTION

- A. Provide final protection to ensure that moisture does not enter bus assembly.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain systems.
 1. Train Owner's maintenance personnel on procedures and schedules for starting up and shutting down, troubleshooting, servicing, and maintaining equipment and schedules.
 2. Review data in maintenance manuals.
 3. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
 4. Schedule training with Owner, through Construction Manager, with at least seven days' advance notice.

END OF SECTION 16465